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UNITED STATES DEPARTMENT OF AGRICULTURE



BULLETIN No. 288



Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C.



September 7, 1915

CUSTOM GINNING AS A FACTOR IN COTTON-
SEED DETERIORATION.

By D. A. SAUNDERS, *Plant Breeder*, and P. V. CARDON, *Assistant Agronomist, Office of Crop Acclimatization.*

INTRODUCTION.

The admixture of cotton seed is largely responsible for the rapid deterioration of cotton varieties which is so apparent throughout the cotton belt, and which, to a large extent, is directly traceable to the planting of seed which has been mixed at the custom gins. When plants of different varieties of cotton grow in close proximity, cross-fertilization takes place through the aid of insects and other pollen-bearing agencies, with the result that varieties become interbred and deterioration follows. Hitherto, however, nothing has been published which fully emphasizes the extent of the mixing which occurs during the ginning process, and consequently the seriousness of the evil is not generally appreciated.

The lack of definite information on this point is due, no doubt, to the difficulty in making accurate determinations of the actual amounts of seed of different varieties present in the admixture under observation. This difficulty arises from the fact that the seeds of most of the more common varieties are so similar in appearance that it is almost impossible to distinguish between them. To overcome this difficulty and to measure the degree of mixture with reasonable accuracy a method was devised by one of the writers, Mr. Saunders, at Greenville, Tex., in 1914. The results obtained from an application of this method show that mixing occurs to a far greater extent than is commonly supposed, and emphasize the necessity of materially modifying common ginning methods if supplies of pure seed are to be maintained. Full appreciation of these facts

NOTE.—This bulletin should be of service to all who are interested in the production and maintenance of pure cotton seed.

should prompt individuals and communities interested in keeping their cotton seed pure to bring about some form of cooperation with ginneries to effectively provide against the admixture of varieties at the gin.

THE POSSIBILITY OF MIXING SEED.

The matter of preserving the purity of cotton varieties has not been given attention in the designing of ginning machinery, and the different machines and their accessories are installed without reference to the amount of seed mixing likely to occur. Since either the quantity of seed cotton ginned or the output of baled lint governs the profits of the ginner, he usually operates his plant from the standpoint of output alone, the seed question being purely secondary with him. Consequently there are several stages in the ginning process where mixing occurs unless certain precautions are exercised.

The methods generally employed in the operation of custom gins are about as follows:

A patron's seed cotton is taken up from his wagon by suction and is conveyed by the same force through flues to the battery of gins. The manner in which the seed cotton is distributed to the different gins, usually two to four in number, and the condition in which it enters them vary somewhat with the type of ginning outfit used. Usually, however, the distribution is preceded by a certain amount of mechanical beating and pulling, the purpose of which is to clean the seed cotton as much as possible and properly condition it for the actual ginning operation.

The seed cotton enters each gin through a kind of box called the feed box, or feeder. The space between the feeder and the saws, where the actual separation of lint and seeds takes place, is inclosed by a concave metal surface, and this inclosure is called the roll box.

Upon entering the roll box the seed cotton falls upon the ribs of the gin breast. Here the saws, one of which protrudes between each pair of ribs, catch the lint in their rapid, revolving motion, pull it from the seeds, and carry it on their teeth to the brushes, which in turn take it off the saws and pass it into the lint flues, through which it is conveyed by suction to the press. The seeds, being unable to pass between the ribs with the lint, fall back and are diverted by means of an inclosed metal apron into the seed conveyor. This conveyor, which usually consists of a screw or a belt in a groove or trough arranged directly under the gins, takes the seed either to hoppers, from which it may be dumped into the patron's wagon, or to the seed house, from which it will later be shipped to the oil mill.

As the saws tear through the seed cotton first fed into the roll box they give to the mass a rotary motion. This revolving mass soon assumes the shape of a roll, which gives rise to the name "roll box."

Gradually most of the lint in the roll is removed, and it becomes more truly a roll of seed. The regulated supply of seed cotton subsequently fed into the roll box revolves upon the roll, the lint is caught by the saws and carried away, and the seeds remain as part of the roll or drop out into the conveyor. Thus, there is a constant exchange of seed in the roll.

Once formed, the roll is seldom removed, but usually is allowed to remain through long periods of ginning. The ginner ordinarily tries to avoid having the roll run out or dropped, which would necessitate the formation of a new one when the next lot of cotton is fed to the gin. Sometimes the gins are stopped just before the last seed cotton of a patron passes out of the feeders, and the amount remaining is ginned as the first part of the next patron's cotton. Usually, however, the gin is run several minutes

after the last of a patron's cotton leaves his wagon, in order to empty the feed boxes and practically free all of the seed in the roll box from lint before the next lot of cotton enters.

This brief description is sufficient to make clear the fact that where different varieties are ginned consecutively in the same gins mixing is inevitable unless precaution is exercised. Though the flues which convey the seed cotton are constructed with a view to facilitating the free and rapid movement of the mass, there are usually a few places where a small quantity of seed cotton may catch and remain to be collected by the passing bulk of the next lot. The amount of mixing at this juncture, however, is very slight. Mixing occurs also in the distributing, cleaning, and feeding devices, though this, too, is comparatively unimportant. The first place at which extensive mixing occurs (the place, in fact, where most of the mixing takes place) is in the roll box. Though further mixing occurs in the seed conveyor, mixing in the roll box calls for first consideration.

MIXING SEED IN THE ROLL BOX.

Seeds in the roll remaining in each roll box after the ginning of one variety gradually are replaced by seeds of the next variety as it passes through the gins. The replaced seeds are mixed with seeds of the variety being ginned, and together they drop into the conveyor and thence into the patron's wagon. The amount of mixing which occurs in the roll box clearly depends upon the rapidity with which the exchange of seeds takes place. As a means of determining the rapidity of exchange and the consequent amount of mixing, the method here described was employed:¹

The seed roll was removed from a 70-saw gin and the seeds were stained red with ordinary dye in order to mark them distinctively. Then they were thoroughly sun-dried and finally returned to the roll box. The roll was packed as near as possible to the density it had before being removed. When the next bale was ginned, samples of the seed were taken every five minutes from the gin containing the colored roll as the seed dropped into the conveyor. The proportion of red seeds in each sample was then determined. The results of these determinations are given in Table I. (See also figs. 1 to 5.)

TABLE I.—*Extent of mixture in samples of cotton seed taken from the roll of a single gin stand in a battery of three stands at intervals of 5 minutes, as determined at Greenville, Tex., Sept. 7, 1914.*

Time of sampling after ginning had begun.	Number and character of seeds in each sample.			Red seed.
	Total.	White.	Red.	
5 minutes.....	521	250	271	<i>Per cent.</i> 52.0
10 minutes.....	478	396	82	17.1
15 minutes.....	527	488	39	7.4
20 minutes.....	835	812	23	2.8
25 minutes.....	603	600	3	.5
30 minutes.....	801	800	1	.1

¹ The writers wish to acknowledge the assistance rendered in this experiment by Mr. George Chandler, whose gin was used in securing the results presented herein.

For several minutes only stained seed appeared. After the gin had been running 5 minutes the sample taken showed 52 per cent of colored seed. At the end of the first 10 minutes the sample showed 17.1 per cent of stained seed and after 15 minutes 7.4 per cent, while at the end of 20 minutes 2.8 per cent of stained seed appeared

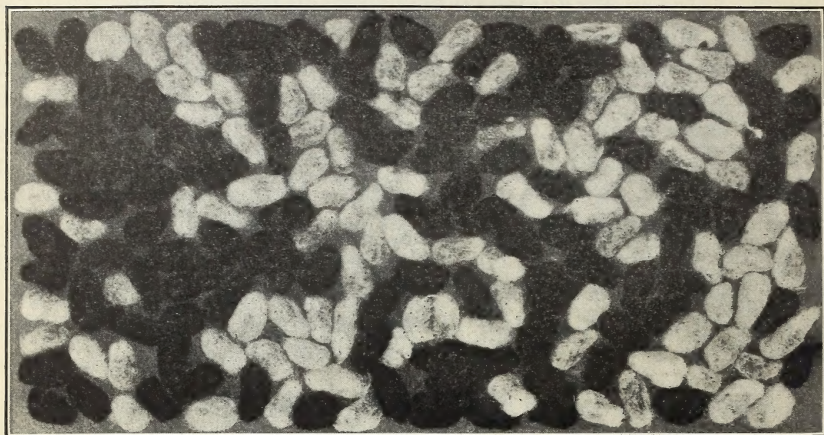


FIG. 1.—Sample of cotton seed taken 5 minutes after the ginning of the second bale had begun, showing 52 per cent of red seed from the stained roll of the first bale.

in the sample. The sample taken at the end of 25 minutes showed 0.5 per cent of stained seed, and the one taken at the 30-minute period showed 0.1 per cent, or 1 seed in a sample of 801 seeds.

When the bale was ginned, the roll was carefully examined and 32 stained seeds were found. Not until 10 minutes after the second bale had been started did these

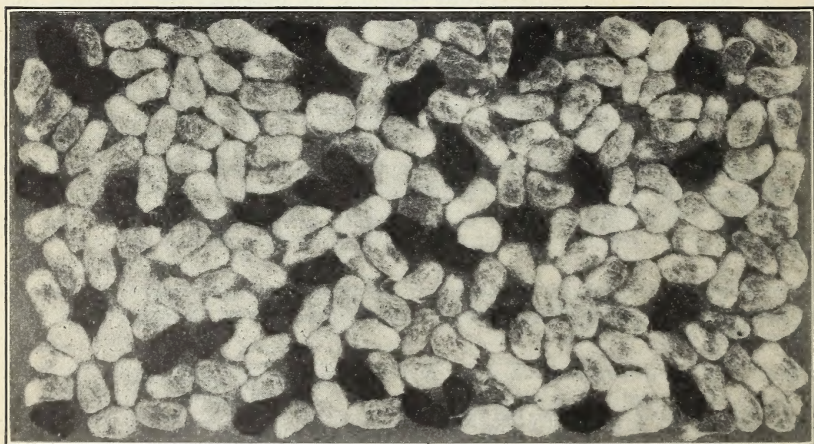


FIG. 2.—Sample of cotton seed taken 10 minutes after the ginning of the second bale had begun, showing 17.1 per cent of red seed from the stained roll of the first bale.

pass out of the gin. No stained seeds were found in the roll box after the ginning of the second bale.

These results indicate that the exchange of seeds in the roll takes place very rapidly, practically the entire roll being replaced during

the ginning of a single bale. Most of the red seeds passed out of the roll box during the first few minutes the gin was in operation. It is possible that if it had not been necessary to remove the roll



FIG. 3.—Sample of cotton seed taken 15 minutes after the ginning of the second bale had begun, showing 7.4 per cent of red seed from the stained roll of the first bale.

to stain it (that is, if a stained roll could have been formed in the normal way) mixing might have been apparent through a longer period of time; but it is reasonable to believe that the results obtained would not have been modified materially.



FIG. 4.—Sample of cotton seed taken 20 minutes after the ginning of the second bale had begun, showing 2.8 per cent of red seed from the stained roll of the first bale.

These results were obtained from only one gin. It is evident that in a battery of four or more gins the chance of mixing seed is greatly increased. However, taking these results as a basis, rather dependable calculations can be made for the purpose of

showing in round numbers about how much mixing may occur. Each roll contains from 35 to 40 pounds of seed, or slightly more than a bushel. The four rolls in a 4-gin battery therefore would contain from 140 to 160 pounds, or from 4 to 5 bushels of seed. If most of these passed out of the roll boxes during the ginning of a bale of cotton, as is indicated by the results at hand, they would comprise from 14 to 16 per cent by weight of the total quantity (about 1,000 pounds) of seed usually obtained by the patron from the seed cotton necessary to make a bale of lint.

While such an admixture in itself is sufficient to justify a demand for more care than is ordinarily exercised at custom gins, it must be remembered that the roll box is not the only source of mixture at the gin.

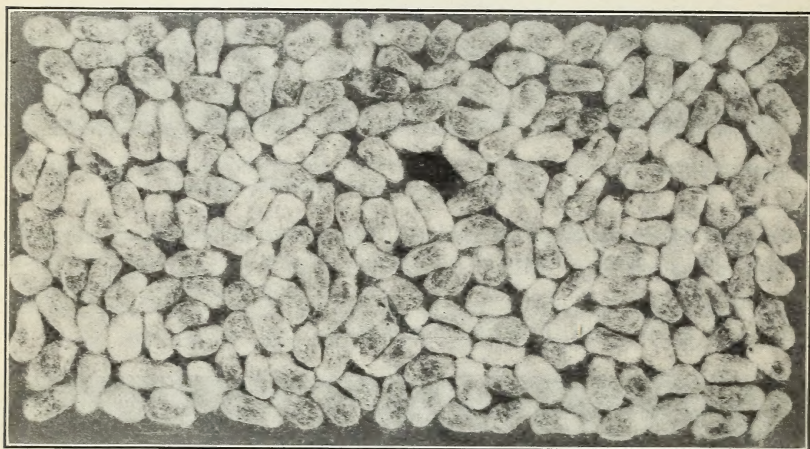


FIG. 5.—Sample of cotton seed taken 25 minutes after the ginning of the second bale had begun, showing 0.5 per cent of red seed from the stained roll of the first bale.

OTHER SOURCES OF MIXTURE.

It has already been pointed out that some mixing may occur before the seed cotton reaches the roll box, and also that further mixing occurs in the seed conveyor. While it is impossible to determine the amount of mixing which may occur in the flues, it may be measured in the seed conveyor by a continuation of the method employed in making determinations in the roll box.

Such determinations were not made at Greenville, but it was observed that even after the second bale was ginned red seeds were found scattered along the conveyor from the gin to the seed house. Thus, while the seed was badly mixed before it was delivered into the conveyor, it was mixed more and more thoroughly as it was stirred and crowded forward by the conveyor screw. For this reason it is apparent that the amount of mixture in the seed delivered to the patron is even greater than is indicated by the determinations made at the gin.

SIGNIFICANCE OF THE RESULTS OBTAINED.

Previous publications¹ of the Department of Agriculture have described methods of selecting cotton and ways of maintaining through community action the supply of pure seed. While there are already many individuals who recognize the value of pure seed and are much concerned about maintaining a permanent supply, it is likely that the movement for better cotton will develop very rapidly in the next few years. That careful methods of selection must be supplemented by careful ginning methods if the movement is to succeed is made clear by the results here discussed. Farmers must take steps to minimize mixing at custom gins if they are to maintain the purity of their improved varieties and in this way prevent deterioration.

It has been shown that no less than 14 to 16 per cent, and probably much more, of the seed delivered to a patron at custom gins as ordinarily operated is seed of the variety ginned just previous to the arrival of his cotton. The results at Greenville indicate also that some seeds from the second bale preceding are likely to appear in the seed delivered to the patron. This means that if different varieties are being ginned consecutively a patron will receive in the seed delivered to him at the gin an admixture of at least three varieties. It is apparent that if such seed is planted opportunity is afforded for a vast amount of cross-fertilization in the field, and deterioration begins. During the next ginning process one or more other varieties may be added to the mixture and still further opportunity for crossing is afforded. Thus, a farmer may start out with an improved variety and in a few years find that his crop ceases to show marks of improvement and more nearly represents a composite stock of many varieties. Deterioration has developed so far that the bolls are small, the yield is light, the plants are not storm-proof, and the fiber produced is of poor quality and brings only low prices.

WAYS OF MINIMIZING THE AMOUNT OF MIXING.

It should be possible for interested patrons to establish some understanding with the ginner whereby he will cooperate in taking precautions aimed at minimizing the amount of mixing likely to occur. The precautions which appear most practicable and which even now are exercised in some localities involve the following steps:

The patron should accompany to the gin the lot of seed cotton from which he expects to save seed for planting, and he should aid the ginner in seeing that everything possible is done to prevent mixing.

He should see that the flues, feeders, and cleaners are cleaned as thoroughly as their construction will permit before he allows his seed cotton to enter them.

The roll should be dropped from the roll box and the box should be thoroughly cleaned. The dropping of the roll is an operation with which all ginnermen are familiar.

¹ Cook, O. F. Cotton selection on the farm by the characters of the stalks, leaves, and bolls. U. S. Dept. Agr., Bur. Plant Indus. Circ. 66, 23 p., 1910.

—— Cotton improvement on a community basis. U. S. Dept. Agr. Yearbook, 1911, p. 397-410. 1911.

The construction of the gins is such that the roll can be dropped and the box cleaned in a very few minutes. Some improved gins are arranged so that the roll box may be emptied without stopping the gin, thereby further simplifying the operation.

Having cleaned the machinery up to and including the roll box, the next step is to prevent the seed of the variety to be ginned from falling into the conveyor. It is impracticable to clean the conveyor satisfactorily, and therefore it should not be used when planting seed is to be obtained. By adjusting the position of the apron of each gin the seed can be made to fall upon the floor in front of the gin instead of into the conveyor. From here it can be sacked easily.

The floors about the gins should be cleaned to the extent that no seeds are left lying around to cause mixing. Canvas spread upon the floor to receive the seed from the gins is often used.

Such precautions require time in which to carry them out effectively, and time spent in this manner naturally reduces somewhat the amount of ginning that otherwise could be done in a day. On this point the ginner may find cause to base objection to such procedure, but it should be possible to meet the objection by fully compensating him for the extra time consumed. The expense of special ginning in some sections may be reduced by arranging to have it done on specified days or at the close of the season, when more time is available. In any event, the amount of money that may be required to secure the ginner's cooperation in the maintenance of pure seed is almost negligible in view of the favorable effect such precautions will have upon the farmer's crops in succeeding years.

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